# CIE Reviewer's Independent Report on

# Alaska Rockfish Stock Assessment

**Prepared by**

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**Prepared for**

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**April 9-11, 2013**

## Contents

## Executive Summary

The Review of Alaska Rockfish Stock Assessment met at the Alaska Fisheries Science Center, Ted Stevens Marine Research Institute, in Juneau, Alaska, over 9th – 11th April 2013. The Alaska rockfish stock assessment review was Chaired by Dr James Ianelli, and the Center for Independent Experts (CIE) review panelists were Drs Cathy Dichmont, Neil Klaer and Sven Kupschus. Presenters on various aspects of Alaska rockfish data collection, biology and stock assessment were Tony Gharrett, Dana Hanselman, Jon Heifetz, Peter Hulson, Jim Ianelli, Chris Lunsford, Phil Rigby, Chris Rooper, Kalei Shotwell, Paul Spencer, Ingrid Spies and Cindy Tribuzio.

### Findings by term of reference

**a. Evaluation of data used in the assessments, specifically trawl and longline survey abundance estimates, and recommendations for processing data before use as assessment inputs.**

Catch data and trawl and longline survey abundance estimates have been prepared and used in stock assessment appropriately. Improvements that can be made are in summarizing the nature of the entire fishery in relation to fishing method, region and targeting, generation of alternative plausible catch histories where significant uncertainty exists, and standardization of survey indices to account for the clumped distribution of catches.

**b. Evaluation of analytical methods used in assessments, particularly in regard to selectivity, selection of age and length bin structures, data weighting assumptions, and assumptions and modeling of trawl and longline catchability.**

Age-structured assessment methods have been applied to rockfish in a manner that allows the results to be used for management advice. Assessment documentation would be improved by the inclusion of bridging analyses, sensitivity tests and improved diagnostics. There is scope for simplification and a more standardized procedure for modeling selectivity change through time for GoA and BSAI Pacific ocean perch (POP). Age and length bins currently used seem appropriate. While there are inconsistencies across assessments in how input data sources are weighted, the methods employed have been well justified. Attention has been given to calculation of absolute survey biomass values so that resulting q values are close to 1 as estimated by age-structured stock assessments. This gives some confidence in the assumptions made in constructing the absolute survey biomass values. There is scope to use Stock Synthesis (SS) as an alternative assessment model for model validation, hypothesis testing and also the development of a length-only assessment procedure.

**c. Evaluation, findings, and recommendations on the analytic approach used for "data-poor" rockfish stocks and complexes, including the use of an age-structured model for a two-species complex, and application of state-space production models to stocks and stock complexes.**

Analytical approaches used for the data-poor rockfish species and complexes are appropriate and suitable for providing management advice. Improvements are possible by considering assessing complexes as a group based on measures of the quality of individual species survey indices. The use of state-space models to smooth survey indices is justified and should continue. There is potential to extend the Tier system lower to include risk analysis for species where any form of quantitative assessment is not possible. Where an age-structured assessment has been applied to a complex, the members of the complex have been biological similar enough to justify such a treatment. There is considerable potential to apply MSE to help evaluate alternative assessment and management procedures to rockfish.

**d. Evaluation, findings, and recommendations on the adequacy of current levels of spatial management, including apportionment strategy.**

Methods used in rockfish stock assessments to account for spatial structure and used to apportion TACs are appropriate, and it is acknowledged that some aspects are in revision given recent additional work. Recent genetic studies suggest that rockfish move relatively small distances on a generational time-scale. Large-scale management regions are likely to contain sub-populations so it is important to ensure that fishing effort is more generally spread in proportion to biomass. Assessment at the broad-scale regional level of BSAI and GOA is justified; however, the implications of assessments of stock with sub-structuring are best evaluated by MSE. There is considerable inconsistency in methods used for spatial apportionment of TACs and assessment of population status which should be removed as far as practicable.

**e. Recommendations for further improvements**

A list of recommendations for further improvements was developed and provided.

# 1 Introduction

## 1.1 Background

The Review of Alaska Rockfish Stock Assessment met at the Alaska Fisheries Science Center, Ted Stevens Marine Research Institute, Juneau Alaska during 9th – 11th April 2013. The Alaska rockfish stock assessment review was Chaired by Dr James Ianelli, and the Center for Independent Experts (CIE) review panelists were Drs Cathy Dichmont, Neil Klaer and Sven Kupschus.

Presenters on various aspects of Alaska rockfish data collection, biology and stock assessment were Tony Gharrett, Dana Hanselman, Jon Heifetz, Peter Hulson, Jim Ianelli, Chris Lunsford, Phil Rigby, Chris Rooper, Kalei Shotwell, Paul Spencer, Ingrid Spies and Cindy Tribuzio, Notes on discussions during the meeting were taken by Kalei Shotwell.

The meeting format included presentations mixed with questions and open discussion. The Panel participated in the review of each term of reference.

## 1.2 Review Activities

Prior to the review, the Panel had already developed a list of sensitivity tests and additional diagnostics for the age-structured Tier 3 Pacific ocean perch (POP) Gulf of Alaska (GoA) and Bering Sea/Aleutian Island (BSAI) rockfish stock assessments, so these were given to the assessment teams on the first day of the review to allow time to complete those tasks. During the meeting, work was shared among the Panel, with no specialist tasks assigned to a particular reviewer.

**Tests requested by the panel**

1. Diagnostics such as:
    - residuals plots of survey, cpue, length and age of base case of both POP assessments (where relevant)
    - retrospective for F and recruitments
    - All age composition plots (e.g. Fig 9-8) of both GOA and BSAI POP scaled to N
2. Can they give us the assessment files for POP esp. .cor and eigenvalue files (.dat and .tpl files)
3. Sensitivity tests of BSAI and GOA POP assessment
    - Change weights in the likelihood (1/5 and times 5) on (* denotes priority):
        - *survey
        - and age and length composition
        - penalty on F regularity
        - *reduce penalty on catch (1/5)
    - *Fixed M = 0.05 yr-1
    - *Higher variance on M prior
    - *Increase deviance vector for recruitment vector (double)
    - GOA POP - 1996-2011 fishery selectivity to beta-logistic (as the one before)
    - *BSAI and GOA POP constant selectivity over time
    - GOA POP drop up to 1987 indices
    - POP catch 1960-1970 half to double
4. Provide likelihood table for the tests that correspond to the base case e.g. table 9-12; only need MLE run.

## 2 Findings by term of reference

### a. Evaluation of data used in the assessments, specifically trawl and longline survey abundance estimates, and recommendations for processing data before use as assessment inputs.

Catch data and trawl and longline survey abundance estimates have been prepared and used in stock assessment appropriately.

Fisheries in the BSAI and GoA regions that catch rockfish are complex – varying particularly by target species, gear type and sub-region. It would be useful for situations such as this review to have a summary of the fisheries in the region that encapsulates this complexity. I was unable to make such a summary from the documents for all of the main rockfish species, but the tables given in Spies and Spencer [6] (e.g. Table 1) provided that kind of information for other BSAI rockfish species. For management purposes, such information becomes more valuable when the effect on the wider fishery of the adjustment of the TAC for an individual species or group needs to be anticipated. A procedure to make such a fishery-wide summary by target species is given in Klaer and Smith (2012). I am not recommending that this particular approach be implemented, but that methods to examine the whole fishery be developed.

A summary of all surveys used for stock assessment in both the BSAI and GoA regions was developed during the meeting (Table 2). Such a summary is also useful general background for purposes such as this review, especially because of different naming conventions in the documentation (e.g. AI bottom trawl survey, AI upper slope survey).

In both BSAI and GoA the historical catch of most/all rockfish species is not well known. This is particularly so in the early years of large catches by Russian and Japanese fleets, both for the total catch and the species composition of the catch. Where considerable uncertainty exists about historical catch history, the effect of this on stock assessment results should be considered. The simplest way to account for this uncertainty is to develop alternative plausible catch histories to be used when making stock assessments. During this review, the sensitivity of the POP assessments to a halving and doubling of the 1960-1970 catches was explored as an example.

As rockfish are not as abundant and widespread as the main fishery target species, survey data for these species tend to be clumped or over-dispersed, often with many zero catch records. In such circumstances, a two stage delta procedure or use of a zero-inflated distribution to

standardize the abundance index may better account for the survey error and increase the precision of survey estimates.

Recent work using a manned submersible has questioned the sampling efficiency of longline for shortraker and rougheye rockfish, and previous work demonstrated a negative correlation between sablefish and rockfish catch rates giving evidence of hook competition. Studies have therefore mostly demonstrated that longline is a less suitable method for indexing the abundance of rockfish than demersal trawl. The longline abundance estimates are currently used for the stock assessment of GoA rougheye and blackspotted rockfish in combination with the trawl survey mainly because the trawl survey does not occur in their preferred habitat. This combined approach for these species seems reasonable. While longline survey abundance estimates appear to have questionable value for rockfish, associated collections of length, age and tag and release (for thornyheads) data are certainly useful.

Table 1. Example of catch by sub-fishery and target species from Spies and Spencer [6]

Total catch (t) of AI dusky rockfish from 2004-2012 by target fishery and gear type. Areas 541, 542, and 543 refer to NMFS areas within the AI. Source: NMFS AKRO BLEND/Catch Accounting System, accessed October 15, 2012.

| Gear | Target | 541 | 542 | 543 | Sum |
|---|---|---|---|---|---|
| Longline | Arrowtooth Flounder | 0.00 | 0.17 | 0.00 | 0.17 |
| Bottom Trawl | Arrowtooth Flounder | 9.50 | 0.00 | 0.00 | 9.50 |
| Bottom Trawl | Atka Mackerel | 1204.52 | 354.20 | 60.48 | 1619.20 |
| Longline | Greenland Turbot | 0.00 | 0.31 | 0.00 | 0.31 |
| Bottom Trawl | Kamchatka Flounder | 7.16 | 0.00 | 0.00 | 7.16 |
| Longline | Pacific Cod | 46.72 | 29.60 | 16.99 | 93.30 |
| Bottom Trawl | Pacific Cod | 30.99 | 5.59 | 2.96 | 39.54 |
| Pot | Pacific Cod | 0.03 | 0.41 | 0.00 | 0.44 |
| Pelagic Trawl | Pollock | 0.06 | 0.00 | 0.00 | 0.06 |
| Bottom Trawl | Rockfish | 68.03 | 34.47 | 20.51 | 123.00 |
| Longline | Sablefish | 0.08 | 0.06 | 0.00 | 0.14 |
| Longline | Halibut | 0.03 | 0.32 | 0.00 | 0.34 |
| Sum | | 1367.12 | 425.12 | 100.93 | 1893.17 |

Table 2. Bering Sea/Aleutian Islands and Gulf of Alaska survey summary

| Survey | Years | Area | Method | Target species |
|---|---|---|---|---|
| Acoustic-trawl survey | 2011 | GOA shelf | Acoustics/Aleutian Wing Trawl | Pollock |
| Acoustic-trawl survey | 1977-2012 | Eastern Bering Sea shelf | Acoustics/Aleutian Wing Trawl | Pollock |
| GOA Bottom trawl survey (previously Cooperative US-Japan and US-USSR) | 1984-2012 (triennial until 2000, then biennial) | GOA slope and shelf | Poly'Noreastern bottom trawl | Multispecies groundfish |
| AI Bottom trawl survey (previously Cooperative US-Japan and US-USSR) | 1980-2012 (triennial until 1999, then biennial) | AI upper slope and shelf | Poly'Noreastern bottom trawl | Multispecies groundfish |
| EBS shelf bottom trawl survey (previously Cooperative US-Japan) | 1977-2012 (annual) | Eastern Bering Sea shelf | 83-112 Flatfish trawl | Multispecies groundfish |
| EBS slope bottom trawl survey | 2002, 2004, 2008, 2010, 2012 | Eastern Bering Sea slope | Poly'Noreastern bottom trawl with mud sweeps | Multispecies groundfish |
| Longline survey (previously Cooperative US-Japan) | 1979-2012 | Eastern Bering Sea, Gulf of Alaska and Aleutian Islands slope | Longline gear | Sablefish |

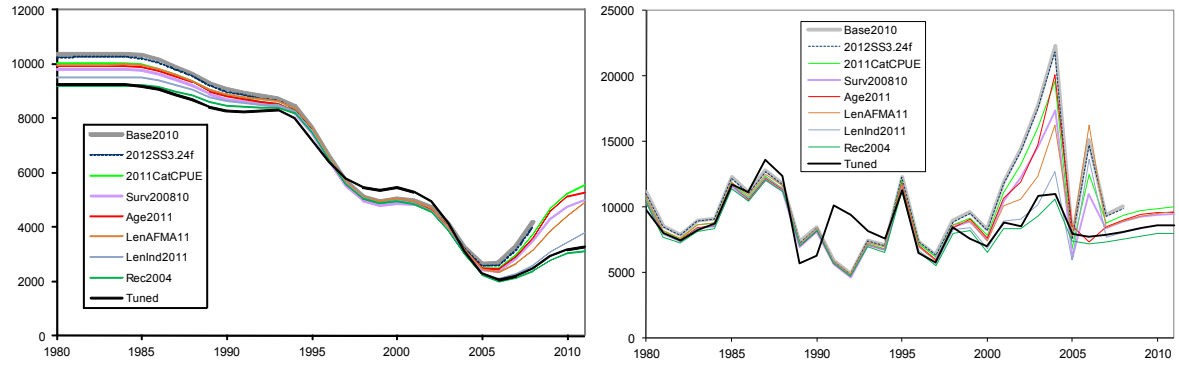
**b. Evaluation of analytical methods used in assessments, particularly in regard to selectivity, selection of age and length bin structures, data weighting assumptions, and assumptions and modeling of trawl and longline catchability.**

Age-structured assessment methods have been applied to rockfish in a manner that allows the results to be used for management advice.

Advice received prior to the review from the AFSC recommended that reviewers concentrate their effort on the age-structured stock assessments for BSAI and GoA POP in particular. There are seven separate rockfish Tier 3 assessments, but all are based on the same ADMB template and assessment type, so it was assumed that any review comments would likely apply across all Tier 3 assessments. Given that this review was only three days, examining other TORs as well, it was not possible to examine an individual Tier 3 assessment for a single species in the level of detail that we would have preferred. The Panel was able to produce on the first review day a list of sensitivity tests to examine for both POP assessments, so that the assessment teams had sufficient time to make those runs and compile the results for examination during the review. The assessment documents should routinely contain sensitivity analyses that explore each of the main stock assessment uncertainties. It was explained that sensitivities had been examined in assessment meetings prior to the review, but they should have been available to the review also, preferably as part of the assessment documentation. The results of the sensitivity analyses requested by the Panel for the GoA and BSAI POP assessments are shown for ABC and 2012 biomass values in Figures 2 and 3. These generally show that the assessments were reasonably robust to a range of alternative major assessment assumptions.

The assessment documentation gave good details on responses to the SSC comments since the last assessment and also compared results from the latest base case with the previous assessment. A procedure used elsewhere that better displays the effect of each change introduced for a new stock assessment is bridging analysis. One way to implement this is to introduce new data and assessment procedures one step at a time in sequence, and to produce plots of biomass and recruitment trajectories (on an absolute scale) so that it can be seen which changes to the previous assessment caused the most change (e.g. see Fig 1).

Figure 1. Example of bridging analysis with biomass and recruitment trends shown.




Documentation for the POP assessments adequately described the procedure implemented to model the population. The equations describing the dynamics for the GoA assessment contain a small confusion: $\hat{C}_y$ is measured in weight, but $\hat{C}_{y,a}$ is in numbers for the composition proportions.

Diagnostic displays in the assessment documents could also be improved with the inclusion of residuals plots for survey, cpue, length and age compositions and retrospective patterns for F and recruitment (as requested by the Panel).

Selectivity change through time was implemented differently in each POP assessment. For the GoA, three time blocks were used for the fishery selectivity, shifting from logistic 1961-76, intermediate 1977-1995 and dome-shaped 1996-2011. This was supported by evidence that the fishery had moved to shallower waters over time and that older larger fish are found deeper. The type of vessels operating in the fishery had also changed roughly according to the three periods. While this approach seems reasonable, sensitivity at least to alternative break years (e.g. 2001-2002 as evidenced by the mean depth plot) could have been examined. For BSAI, selectivity was allowed to vary in blocks of four years throughout, with both the age and slope at 50% selection allowed to vary. This introduced 28 selectivity parameters to be estimated. While the resulting selectivity pattern through time looks plausible and changes relatively smoothly, it was observed that the slope parameter did not deviate appreciably. My preference would be to reduce the number of selectivity parameters which could be achieved in two ways – (1) fix the slope parameter (but continue to test in future for possible change) and (2) as selectivity change was reasonably smooth through time (except 2000), explore the use of a smooth relationship such as a spline to model the

time change with a small number of parameters. Sensitivity to alternative procedures for modeling selectivity change in the BSAI POP assessment should also be examined. Given similarities in the fishery history of BSAI and GoA POP, it would be preferable if similar procedures could be implemented in these assessments to model selectivity change through time. As there are large numbers of 40+ fish showing in the survey there is some evidence for dome-shaped fishery selectivity for BSAI POP which could also potentially be aligned with the GoA.

The fairly unique biology of rockfish where rapid growth occurs at younger ages, and then very little growth thereafter for a long-lived species creates difficulty both in setting the age for a plus group, and therefore also how variations in observed lengths for larger fish are accounted for in the models. Recent work that examined whether extending the plus group age improved fits to data showed some promise for GoA northern rockfish but not for GoA dusky rockfish and BSAI northern rockfish. While additional work could be done to better measure statistically whether the plus group extension is justified, current evidence for extending the plus group is weak.

Considerable effort has been expended to ensure that data used for assessment has been weighted appropriately on input. Assumed CVs for catch were based on the reliability of catch reconstruction. Observed length and age sample sizes from the fishery and surveys were transformed. Justification was given for differing transformations depending on whether the species was common or clustered in distribution. Comparisons were made of input and effective sample size for composition data which were reasonably balanced for the example shown. While there was an effort to standardize the weighting procedure across assessments, the differences that remain appear to be well justified.

Attention has been given to calculation of absolute survey biomass values so that resulting q values are close to 1 as estimated by age-structured stock assessments. This gives some confidence in the assumptions made in constructing the absolute survey biomass values, and also transfers that confidence to lower Tiers where the q value must be assumed to be equal to 1. As with all surveys there may be problems in assuming that q has not changed through time. This has been a source of contention in previous reviews, and resultant efforts to examine possible time-shifts in movement of fish to and from untrawlable ground are commendable.

It is important that the model used for the age-structured assessments is validated – i.e. demonstrated to behave in the way that was intended. The best validation is via simulation – data generated using a simulated fish population with known characteristics is fed to the stock assessment to

see whether the assessment can correctly reconstruct the population. Validation can also be carried out by comparison with an assessment procedure that has been separately validated. This latter procedure provides a reason to explore construction of the rockfish assessments using Stock Synthesis (SS), because many aspects of SS have been validated via simulation. An SS version of the rockfish assessments could also provide a simple means for exploration of additional model options such as inclusion of a stock-recruitment relationship and estimation of growth parameters within the assessment. It is desirable to investigate inclusion of growth parameter estimation within the stock assessment mostly because of the interaction with selectivity. While it has been shown that the proxy MSY reference points used to manage rockfish stocks are probably conservative, I believe that assessments that include a stock-recruitment relationship should still be included at least as sensitivity analyses to be examined and evaluated. The exclusion of assessments with a stock recruitment relationship needs more comprehensive justification.

Figure 2. Effect of sensitivity analyses on ABC values for GoA POP

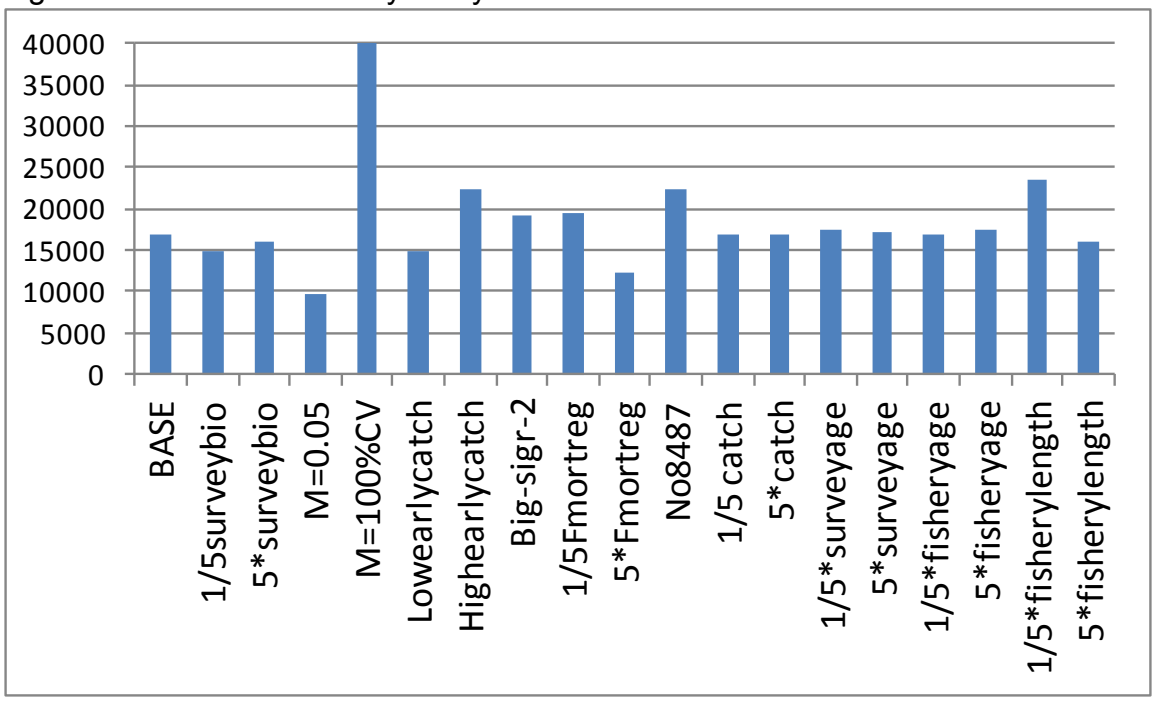
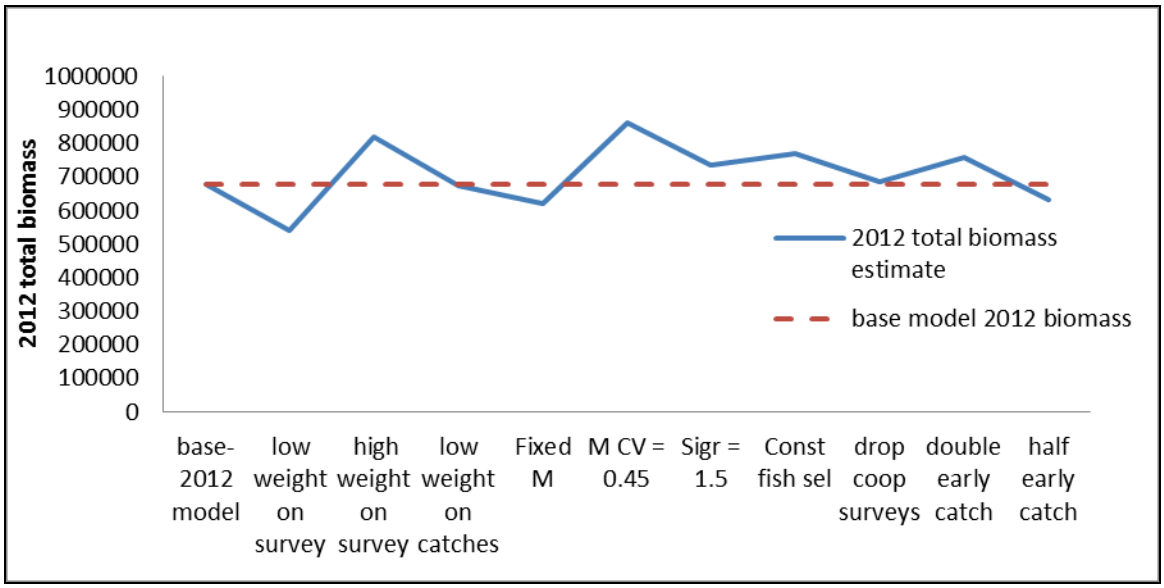



Figure 3. Effect of sensitivity analyses on 2012 biomass estimates for BSAI POP



**c. Evaluation, findings, and recommendations on the analytic approach used for "data-poor" rockfish stocks and complexes, including the use of an age-structured model for a two-species complex, and application of state-space production models to stocks and stock complexes.**

Analytical approaches used for the data-poor rockfish species and complexes are appropriate and suitable for providing management advice.

The Tier system as implemented for Alaskan fisheries seems to be well designed. How well stock reference points can be estimated is a useful basis for distinguishing among Tiers. The data poor Tiers 4 to 6 are the data poor Tiers where data are insufficient to support an age-structured assessment. I agree that when information on maturity completes information required to make yield per recruit calculations that it is best to move species from Tier 5 to Tier 4.

Historical improvements in data availability and stock assessments has meant that species have steadily been individually split out of rockfish complexes that are mainly assessed at the Tier 5 level. This has progressed to the stage for remaining complexes such as the GoA other rockfish that survey indices for individual species in the complex are very noisy and could be considered too unreliable to be used for stock assessment. If there are no specific requirements to assess all species individually I recommend that the remaining complex that contains very data poor species be assessed as a whole. In this situation there would still be a requirement to ensure that individual species are not put at risk, which could better be achieved by a risk assessment, rather than a quantitative stock assessment (e.g. Zhou and Griffiths 2008, Hobday et al. 2011). These risk assessments could potentially be added to the existing Tier system at a lower level such as Tier 7 and 8. The assessment for the complex could remain as a simple Tier 5, but there is also potential to explore multispecies age-structured assessments at Tier 3. Where a single population age-structured model has been applied to a complex (AI blackspot/rougheye) the biology and distribution of the species has been sufficiently similar to support that application. For a complex of more dissimilar species, either a combined Tier 5 or a possible multispecies age-structured assessment is required. It seems to only be appropriate to apply Tier 4 to a complex where the composite species have similar yield per recruit characteristics.

Current efforts to smooth the noisy biomass indices (state space Kalman filter, production model or random walk) should continue. These models

are of distinct advantage compared to 3 year averaging, particularly where there are missing years.

Management strategy evaluation (MSE) can help to resolve many of the difficult rockfish problems – single species issues such as the relative effectiveness of abundance index averaging procedures for assessment and also apportionment, to multi-species issues such as splitting or grouping the assessments of complexes. It appears that application of MSE to rockfish is currently limited to the genetic distribution study by Spies, so there is considerable scope to apply the technique more widely to existing and potential rockfish harvest strategies.

**d. Evaluation, findings, and recommendations on the adequacy of current levels of spatial management, including apportionment strategy.**

Methods used in rockfish stock assessments to account for spatial structure and used to apportion TACs are appropriate, and it is acknowledged that some aspects are in revision given recent additional work.

Recent genetic studies that track the dispersal of single generations suggest that rockfish move relatively small distances (less than 200km to 500km) on that time-scale. This means that any large-scale management regions are likely to contain sub-populations with mixing on long time-scales, given the longevity of rockfish. Under this scenario it may be important to ensure that fishing effort is more generally spread in proportion to biomass to help guard against over-exploitation of individual sub-populations. Assessment at the broad-scale regional level of BSAI and GOA is justified given what is known about ocean circulatory patterns and also the level of data required to support any kind of information-rich (Tier 3) stock assessment for these mostly bycatch species. Implications of assessments of stock with sub-structuring are best evaluated by MSE – continuing the work described by Spies on where management lines might best be drawn.

Species such as harlequin rockfish have caused wider fishery problems in the past with rather fine-scale apportionment of the TAC. As discussed under TOR (c), it should first be determined whether the biomass index is of sufficient quality to justify a single species population assessment rather than assessment of an inclusive complex with an associated per-species risk assessment.

At present there is considerable inconsistency in methods used for spatial apportionment of TACs and assessment of population status. These

inconsistencies should be removed as far as practicable, especially to align the apportionment process with any averaging or smoothing of biomass indices used for stock assessment.

**e. Recommendations for further improvements**

The following summarizes specific recommendations made against the TORs above.

- Develop methods to examine and summarize relationships of gear/target species sub-components of the fishery.
- Develop alternative plausible catch histories that capture upper and lower bounds of historical catches for use in sensitivity analyses (and to inform annual CV values for catch in base assessments)
- Explore delta or zero-inflated distributions for survey indices.
- Explore the use of SS3 as the age-structured assessment procedure or for validation of existing models and also for the development of length composition only assessments.
- Improve assessment documentation: (1) provide a bridging analysis to the most recent previous stock assessment if age or length-based (2) provide a more comprehensive diagnostics of model fits including residual plots (3) provide sensitivity analyses for all major assumptions of the stock assessment on both the contribution of all likelihood components, the values estimated by the model, and also principal management outputs such as ABC values.
- Investigate alternative break years for GoA POP selectivity and whether there is sufficient commonality across the regions to use similar selectivity transition by time methods for GoA and BSAI.
- Consider and fully justify the exclusion of assessments that assume a stock-recruitment relationship for age-structured assessments.
- Conduct more maturity studies so that stocks presently in Tier 5 to be considered for Tier 4 classification.
- Simulation testing work being done by the Plan Team working group on managing many spatially disaggregated stocks by complex should continue.
- Consider extending the tier system lower to accommodate risk assessments for species that are too data-poor to be assessed as single species.
- Potential for inclusion of YOY survey indices with better species ID.
- Extend MSE investigations to assist with single species issues such as the relative effectiveness of abundance index averaging procedures for assessment and also apportionment, to multi-species issues such as splitting or grouping the assessments of complexes.

- Ecosystem work on habitat mapping and oceanographic conditions (e.g., currents, sediments, topography, and temperature) should continue, particularly as it will likely have implications for stock assessment (and interpretation of survey data and groundtruthing rockfish population characteristics).

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## Appendix 1. Bibliography

### Bering Sea/Aleutian Islands

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14. Murphy, J. and Ianelli, J. Assessment of the Thornyhead stock in the Gulf of Alaska. pp 1199-1238
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More than 60 supplementary documents were also supplied as background information.

## Appendix 2. Statement of Work

**External Independent Peer Review by the Center for Independent Experts**

### Review of Alaska Rockfish Assessments

**Scope of Work and CIE Process:** The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Representative (COR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

**Project Description:** The Alaska Fisheries Science Center (AFSC) is responsible for stock assessments for 13 rockfish stocks and stock complexes. Collectively these rockfish stocks support valuable commercial fisheries. The last time rockfish stocks were independently reviewed by the CIE was in 2006. Several changes have occurred since that time. New assessments have been developed, several existing assessments have been modified to include new life history information, and the fisheries in the Gulf of Alaska have been rationalized allowing more stocks to be fully utilized. Some assessments have implemented or explored modeling changes such as time-varying selectivity or iterative reweighting of data sources to achieve better variance specification. New information has become available on the spatial population structure of rockfish, which has affected the assessment and management of these species and raised questions if the current spatial management is adequate. In addition, fish formerly identified as rougheye rockfish (*Sebastes aleutianus*) are now known to comprise two species which are assessed together in one age-structured stock assessment model because of misidentification problems. These issues underscore the need for an independent review of rockfish resources in the Gulf of Alaska and Bering Sea/Aleutian Islands.

In addition, there are several stocks that are commercially valuable, but are currently only assessed using survey biomass estimates with reference points based on natural mortality. These stocks often have other demographic and life history data available such as length compositions or maturity estimates, but lack reliable age data. The AFSC would benefit with a review of the current methods for "data-poor" rockfish stocks and recommendations for improved methods.

Alaska rockfish assessments rely strongly on trawl survey biomass estimates, and the previous CIE review identified the need for focused research on the fraction of the stock that resides in untrawlable grounds in order to characterize any potential bias and/or imprecision resulting from expansion of fish densities from trawlable areas to untrawlable areas. Since 2006, scientists at the AFSC have conducted experiments to assess the fraction of the rockfish stocks that reside in untrawlable substrate. A review of this research and recommendations for how to incorporate the results into stock assessments is needed.

Finally, the AFSC longline survey provides a relative population index for several species of Alaska rockfish (~1990-present). This index is currently used in the Gulf of Alaska rougheye rockfish population model, but has potential to be incorporated into other rockfish assessments such as shortraker rockfish (Sebastes borealis). The AFSC would benefit from a review of the current methods for incorporating this index into stock assessments and recommendations for new or improved methods.

The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

**Requirements for CIE Reviewers:** Three CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. Each CIE reviewer's duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein. CIE reviewers shall have the expertise, background, and experience to complete an independent peer review in accordance with the SoW and ToRs herein. CIE reviewer expertise shall have expertise and work experience in analytical stock assessment, including population dynamics, age/length based stock assessment models, data-poor stocks, survey design, and population structure and spatial management. In order to help ensure an independent review, we request three reviewers who did not serve as reviewers in the 2006 Alaska rockfish CIE review.

**Location of Peer Review:** Each CIE reviewer shall conduct an independent peer review during the panel review meeting scheduled during April 29-11, 2013 at the Alaska Fisheries Science Center in Juneau, Alaska.

**Statement of Tasks:** Each CIE reviewers shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review : Upon completion of the CIE reviewer selection by the CIE Steering committee, the CIE shall provide the CIE reviewer information (name, affiliation, and contact details) to the Contract Officer Representative (COR), who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the background documents, reports, foreign national security clearance, and information concerning other pertinent meeting arrangements. The NMFS Project Contact is also responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COR prior to the commencement of the peer review.

Foreign National Security Clearance: When CIE reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the

Foreign National Security Clearance approval for CIE reviewers who are non-US citizens. For this reason, the CIE reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website:
http://deemedexports.noaa.gov/compliance_access_control_procedures/noaa-foreign-national-registration-system.html

Pre-review Background Documents : Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.

AFSC will provide copies of the statement of work, stock assessment documents, prior CIE review documents, and other background materials to include both primary and grey literature.

This list of pre-review documents may be updated up to two weeks before the peer review. Any delays in submission of pre-review documents for the CIE peer review will result in delays with the CIE peer review process, including a SoW modification to the schedule of milestones and deliverables. Furthermore, the CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein.

Panel Review Meeting : Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. **Modifications to the SoW and ToRs shall not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COR and CIE Lead Coordinator.** Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, and their peer review tasks shall be focused on the ToRs as specified herein. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewers as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

Contract Deliverables - Independent CIE Peer Review Reports : Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

Other Tasks – Contribution to Summary Report : Each CIE reviewer may assist the Chair of the panel review meeting with contributions to the Summary Report, based on the terms of reference of the review. Each CIE reviewer is not required to reach a consensus, and should provide a brief summary of the reviewer's views on the summary of findings and conclusions reached by the review panel in accordance with the ToRs.

**Specific Tasks for CIE Reviewers:** The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review;
2) Participate during the panel review meeting at the Alaska Fisheries Science Center in Juneau, Alaska during 9-11 April 2013 as called for in the SoW, and conduct an independent peer review in accordance with the ToRs (Annex 2);
3) In Juneau, Alaska during 9-11 April 2013 as specified herein, conduct an independent peer review in accordance with the ToRs (**Annex 2**).
4) No later than 26 April 2013, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and CIE Regional Coordinator, via email to David Die ddie@rsmas.miami.edu. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in Annex 2;

**Schedule of Milestones and Deliverables:** CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

| | |
|---|---|
| March 1, 2013 | CIE sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact |
| March 25, 2013 | NMFS Project Contact sends the CIE Reviewers the pre-review documents |
| April 9-11, 2013 | Each reviewer participates and conducts an independent peer review during the panel review meeting |
| April 26, 2013 | CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator |
| May 10, 2013 | CIE submits CIE independent peer review reports to the COR |
| May 17, 2013 | The COR distributes the final CIE reports to the NMFS Project Contact and regional Center Director |

**Modifications to the Statement of Work:** Requests to modify this SoW must be made through the COR who submits the modification for approval to the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify

the CIE within 10 working days after receipt of all required information of the decision on substitutions. The COR can approve changes to the milestone dates, list of pre-review documents, and Terms of Reference (ToR) of the SoW as long as the role and ability of the CIE reviewers to complete the SoW deliverable in accordance with the ToRs and deliverable schedule are not adversely impacted. The SoW and ToRs cannot be changed once the peer review has begun.

**Acceptance of Deliverables:** Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COR for final approval as contract deliverables based on compliance with the SoW. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (the CIE independent peer review reports) to the COR (William Michaels, via William.Michaels@noaa.gov).

**Applicable Performance Standards:** The contract is successfully completed when the COR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards: (1) each CIE report shall have the format and content in accordance with Annex 1, (2) each CIE report shall address each ToR as specified in Annex 2, (3) the CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

**Distribution of Approved Deliverables:** Upon notification of acceptance by the COR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COR. The COR will distribute the approved CIE reports to the NMFS Project Contact and regional Center Director.

**Support Personnel:**
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**Key Personnel:**

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## Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations.
2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR, and Conclusions and Recommendations in accordance with the ToRs.
    a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including providing a detailed summary of findings, conclusions, and recommendations.
    b. Reviewers should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.
    c. Reviewers should elaborate on any points raised in the Summary Report that they feel might require further clarification.
    d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.
    e. The CIE independent report shall be a stand-alone document for others to understand the proceedings and findings of the meeting, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.
3. The reviewer report shall include as separate appendices as follows:
   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of the CIE Statement of Work
   Appendix 3: Panel Membership or other pertinent information from the panel review meeting

## Annex 2: Terms of Reference for the Peer Review

### Review of Alaska Rockfish Assessments

CIE reviewers shall address the following Terms of Reference during the peer review and in the CIE reports.

a. Evaluation of data used in the assessments, specifically trawl and longline survey abundance estimates, and recommendations for processing data before use as assessment inputs.
b. Evaluation of analytical methods used in assessments, particularly in regard to selectivity, selection of age and length bin structures, data weighting assumptions, and assumptions and modeling of trawl and longline catchability.
c. Evaluation, findings, and recommendations on the analytic approach used for "data-poor" rockfish stocks and complexes, including the use of an age-structured model for a two-species complex, and application of state-space production models to stocks and stock complexes.
d. Evaluation, findings, and recommendations on the adequacy of current levels of spatial management, including apportionment strategy.
e. Recommendations for further improvements

**Annex 3: Draft Agenda**

# Review of Alaska Rockfish Stock Assessment

**Alaska Fisheries Science Center**
**Ted Stevens Marine Research Institute**
**17109 Pt. Lena Loop Rd**
**Juneau, AK 99801**
**Lower conference room**

***April 9-11, 2013***

Contact for security and check-in: Phil Rigby
Contacts for additional documents: Dana Hanselman/Paul Spencer

***Tuesday, April 9:***
9:00 AM – 10:15 AM: **Introduction/Background**

1. Introductions and agenda – *Phil Rigby/Dana Hanselman*
2. Overview of rockfish biology, fishery, and history of assessment – *Jon Heifetz*
3. Current management of Alaska rockfish – *Jon Heifetz*

10:15 AM – Break
10:30 AM: **Genetics and stock structure**

4. Overview of rockfish genetics – *Gharrett*
5. Evaluation of rockfish stock structure and spatial management – *Paul Spencer*
    a. Case study: Spatial distributions of catch and biomass for AI blackspotted rockfish -- *Spencer*

12:00 PM – Lunch
1:00 PM -3:00 PM: **Input data I**

6. Survey data
    a. Abundance indices
        i. Trawl surveys and untrawlable work – *Chris Rooper*
        ii. Longline survey - *Chris Lunsford*

7. Fishery data – Catch, observer program, ages, lengths – *Dana Hanselman*

3:00 PM – Break
3:15 PM – 3:45 PM**: Input Data II**

8. Ages, precision of age readings, lengths, maturity, and growth – *Pete Hulson*

3:45 PM – Discussions

5:00 PM – Adjourn for day

***Wednesday, April 10:***
9:00 AM – 10:30 AM: **"Data-limited" assessments (not age structured)**

Topics:

9. Overview of assessment tiers and where stocks fit – *Dana Hanselman*
10. Catch and biomass only methods – *Cindy Tribuzio*
11. Kalman Filter models and survey averaging – *Paul Spencer*
12. Ways forward, alternative approaches – *Pete Hulson*

10:30 AM – Break
10:45 AM – **Discussions**
12:00 PM – Lunch
1:00 PM -3:00 PM: **"Data-less-limited" assessments (age-structured)**

Topics:

13. Model structure – *Jim Ianelli*
14. Likelihood formulations, data weighting, age/length bins – *Pete Hulson*
15. Catchabilities, selectivities, natural mortalities, recruitment variability – *Dana Hanselman*

3:00 PM – Break
3:15 PM – Discussions
5:00 PM – Adjourn for day

***Thursday, April 11:***
9:00 AM – 10:30 AM: **Complexes and new research**

16. Age-structured and biomass based complexes – *Kalei Shotwell*
    a. Rougheye/Blackspotted –
    b. "Other rockfish"
17. Rockfish genetic MSE – *Ingrid Spies*

10:30 AM – Break
10:45 AM – Discussions
12:00 PM – Lunch
1:00 PM -3:00 PM: **Current issues and requested topics**

18. Other current topics (as time permits)
    a. Ecosystem considerations
    b. Skip spawning for some rockfish
    c. Length-based model for shortraker
    d. BSAI POP selectivity alternatives
    e. Iterative reweighting of sample sizes

3:00 PM – Break
3:15 PM – **Summarize, revisit Terms of Reference**
5:00 PM – Adjourn meeting

# Appendix 3. List of participants

| Participant | Program | Center | Agency |
|---|---|---|---|
| Dana Hanselman | Marine Ecology and Stock Assessment | Alaska Fisheries Science Center | NOAA |
| Kalei Shotwell | Marine Ecology and Stock Assessment | Alaska Fisheries Science Center | NOAA |
| Chris Lunsford | Marine Ecology and Stock Assessment | Alaska Fisheries Science Center | NOAA |
| Jon Heifetz | Marine Ecology and Stock Assessment | Alaska Fisheries Science Center | NOAA |
| Phil Rigby | Marine Ecology and Stock Assessment | Alaska Fisheries Science Center | NOAA |
| Pete Hulson | Marine Ecology and Stock Assessment | Alaska Fisheries Science Center | NOAA |
| Cindy Tribuzio | Marine Ecology and Stock Assessment | Alaska Fisheries Science Center | NOAA |
| Katy Echave | Marine Ecology and Stock Assessment | Alaska Fisheries Science Center | NOAA |
| Paul Spencer | Resource Ecology and Fisheries Management | Alaska Fisheries Science Center | NOAA |
| Ingrid Spies | Resource Ecology and Fisheries Management | Alaska Fisheries Science Center | NOAA |
| Jim Ianelli | Resource Ecology and Fisheries Management | Alaska Fisheries Science Center | NOAA |
| Chris Rooper | Resource Assessment and Conservation Engineering | Alaska Fisheries Science Center | NOAA |
| Jane DiCosimo | Plan Coordinator | | North Pacific Fishery Management Council |
| Tony Gharrett | Fisheries Division | School of Fisheries and Ocean Sciences | University of Alaska Fairbanks |